

BMW & LAND ROVER Importer
For Guam, Marianas &
Micronesia

Prestige Automobiles

Raphael Hilmi

Service Manager

Address

491 East Marine Drive, Route 1
Dededo, Guam 96929-6225 U.S.A.

Tel: 1-671-633-2698 Ext: 108
Fax: 1-671-633-0888
E-mail: rhilmi@
prestigeautoguam.com

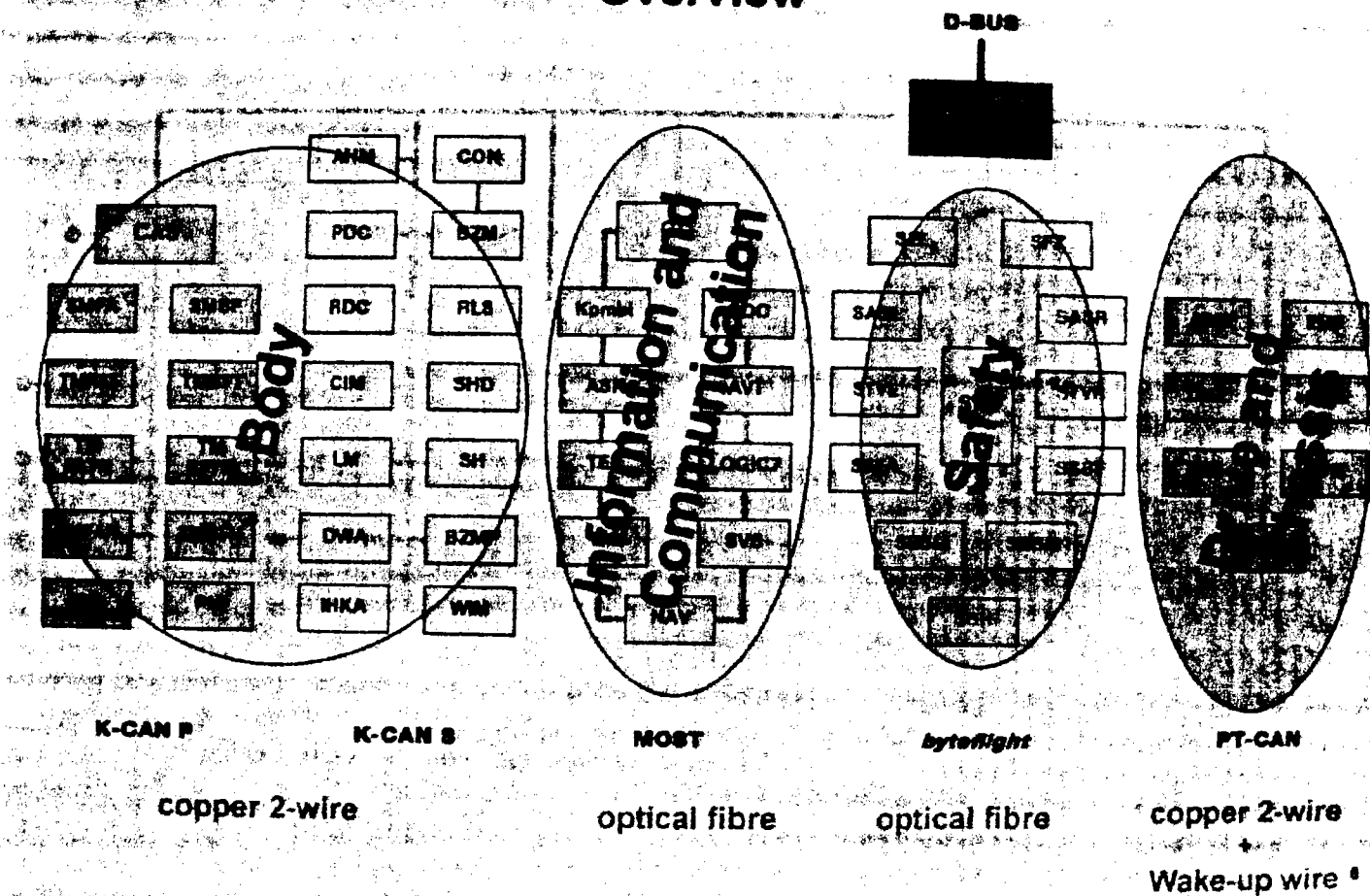


BMW Group
Service Training

International Trainer Conference July 2001
Introduction E65/E66 Vehicle Electrical System



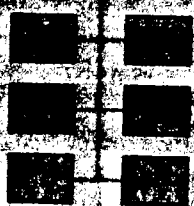
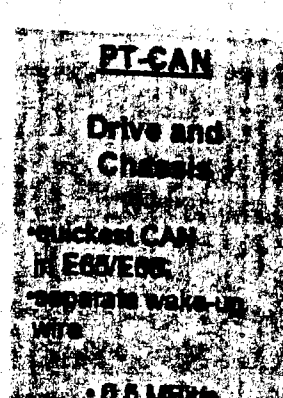
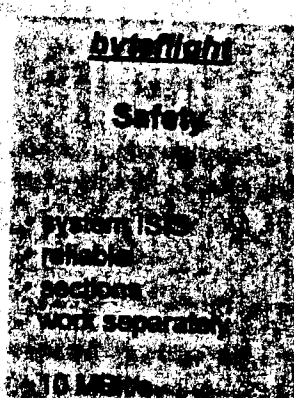
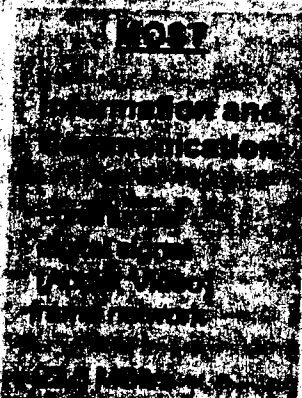
Overview



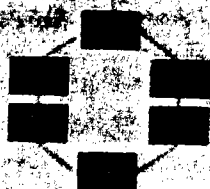
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August 2001

E65 Bus Network

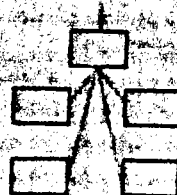
E65 bus networks



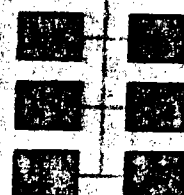
Tree-Structure
copper 2-wire



Ring-Structure
optical fibre



Star-Structure
optical fibre

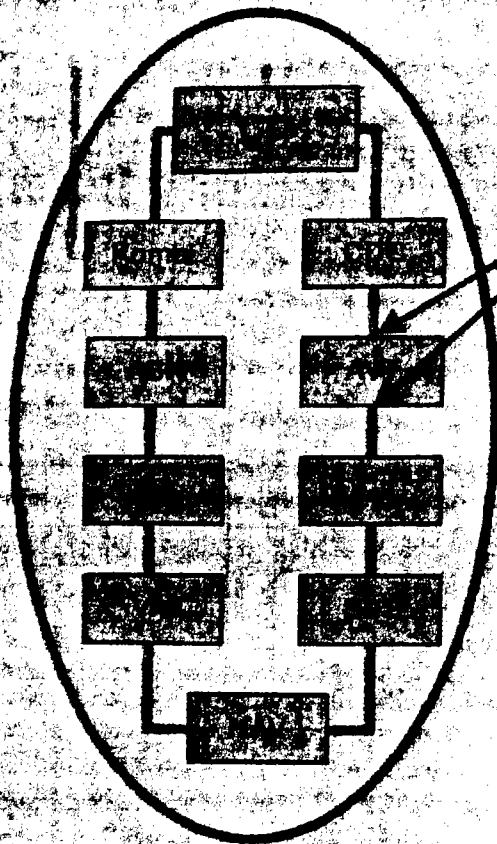


Tree-Structure
copper 2-wire
+
Wake-up wire

BMW Group Australia
Australasia

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2004-08-01
August 2004

E65 Bus Network Optical fibre technology



MOST

Ring structure

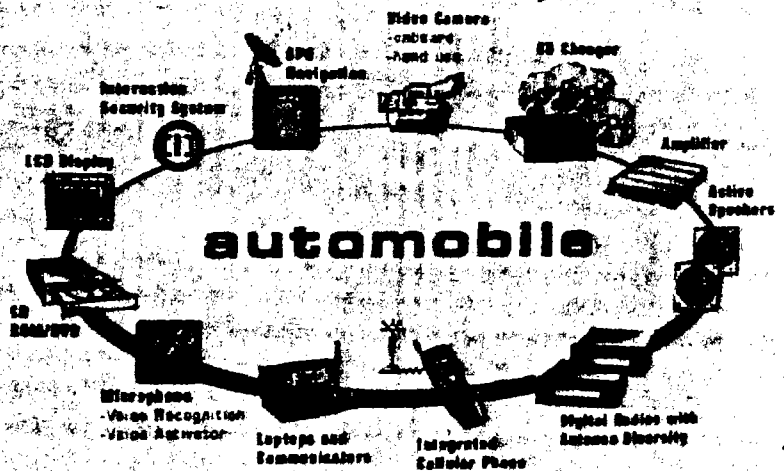
Separate sender and receiver

Large amount of data

Audio-Data and Video-Data

Frame network

Data transmission: 22,5 Mbit/s



BMW Group Australia
Adelaide

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August 2001

E68 Bus Network Optical fibre technology



byteflight

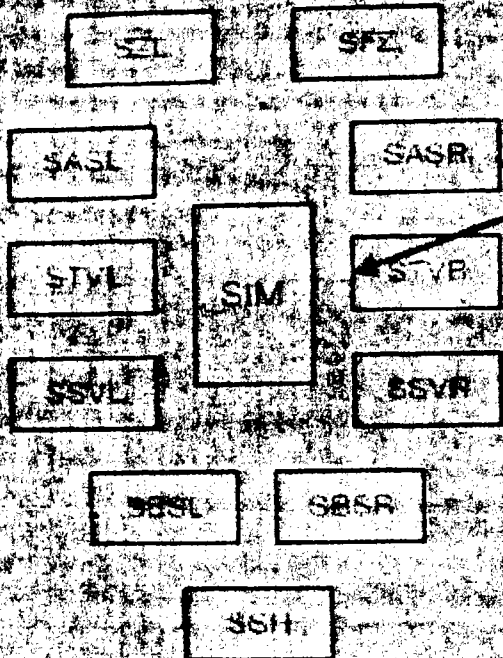
Star structure

Integrated sender and receiver

**High demand on safety data
transmission**

Satellites work separately

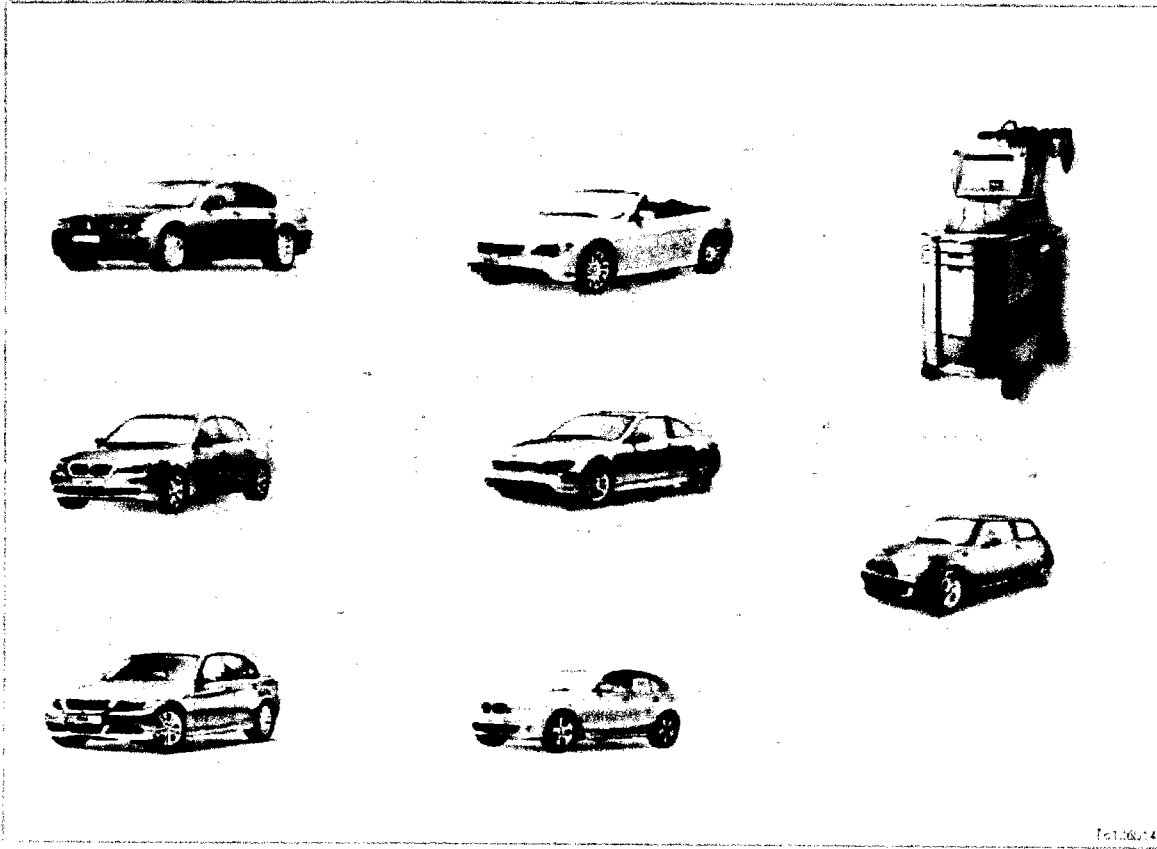
Data transmission: 10 Mbit/s



BMW Group Australia
Alternates

Bus diagnosis

All models from E60



Introduction

In the vehicles of today, components and control units are networked by means of data buses. Data buses are capable of transmitting messages with signals.

The connected control units only read off those messages and signals that are of relevance to their operation.

Most buses are CAN buses (CAN: Controller Area Network). There are several CAN buses with different data transmission rates in each car.

For example, the PT-CAN has a fast data transmission rate, the K-CAN a slower data transmission rate.

A fibre-optic cable is used for navigation and entertainment: the MOST bus (MOST = "Media Oriented System Transport")

There is a separate data wire for diagnosis: the diagnosis wire, also known as the "K-wire".

[for more information, please refer to SI Technology (SBT) 61 03 05 144]

The following options are available for locating faults in data buses and in control units:

- **Test module for diagnosis on the CAN buses in the BMW diagnosis system:**
"Bus system analysis"

The test module is called up in the DIS (Diagnosis and Information System) as follows: "Function selection" button -> Complete vehicle -> Body -> Bus functions -> Bus analysis -> System analysis

- **Checking the terminating resistances:**

- Test module for diagnosis on the MOST buses:
"MOST system analysis"

The test module is called up in the DIS (Diagnosis and Information System) as follows: "Function selection" button -> Complete vehicle -> Body -> Bus functions -> MOST functions -> MOST system analysis.

These two test modules and the installation points of the terminating resistances are described in detail below.

Bus system analysis

The bus system analysis narrows down the cause of **intermittently** occurring faults in the area of the data buses and control units.

The test results of bus system analysis state the following possible causes of fault:

- Data bus XY defective
- Gateway XY defective (= interface for data exchange)
- Control unit XY defective

Note: Diagnosis of intermittent faults and permanent faults.

All cases where a data bus or control unit only fail **temporarily** (i.e. intermittently) are difficult for diagnosis.

In such cases, the entries in the control units' fault memories do not point unambiguously to an intermittent failure of a particular data bus or control unit.

Intermittent failure of a particular data bus or control unit causes many different fault memory entries in several control units.

If a data bus fails **completely** and **permanently**, the affected control units are no longer available for diagnosis. The fault is thus easy to locate.

Note: Path details for the "bus system analysis" test module

The test module is called up in the DIS (Diagnosis and Information System) as follows:

"Function selection" button -> Complete vehicle -> Body -> Bus functions -> Bus analysis -> System analysis

In order to determine the cause of a system fault in the bus system the following prerequisites have been established:

- If a communication fault occurs in the control units of the bus system, then this communication fault is not shown in the fault memory of the control unit concerned. This also means that no "x" appears before this control unit in the short test.
- The quick-test list contains "real" installed control units and a "virtual" control unit with following names:
 - "CAN/byteflight system analysis" on the E65, E66 and on the E60, E61, E63, E64 up to 09/2005
 - "CAN system analysis" on the E87, E90, E91, E92, E93 and R56 and on the E60, E61, E63, E64 from 09/2005

In this case, "virtual" means that this is not a real control unit but a wild card for all control units on the CAN bus or **byteflight**.

- The short test for this "virtual" control unit reads the communication fault from all control units.
- An "x" in front of this "virtual" control unit indicates that the short test has analysed one of the following faults:
 - No communication with the respective gateway (data interface for all busses):

> R56

JBE: Junction box electronics

> E87 or E90, E91, E92, E93

JBE: Junction box electronics

- Breaks in the wiring in a bus
- Intermittent fault in a control unit

Functions of bus system analysis

Bus system analysis is a test module that automatically executes the following steps:

Step 1: Identification of engine type

Identifying the engine type is a prerequisite for bus system analysis, since different engines generate different fault code memory entries for the same cause of fault.

Step 2: Read fault memories of all control units

Step 3: Check fault memory entries for undervoltage

If the vehicle has suffered an undervoltage, the undervoltage is the most likely cause of the bus failure. Bus system analysis checks whether a fault memory entry indicating undervoltage is present in at least 2 control units.

If no undervoltage can be detected, continue with step 4.

Step 4: Check how many fault memory entries were found

If at least 1 fault memory entry is present, continue with step 5.

Step 5: Evaluation of fault memory entries and creation of a list of most probable fault causes

Bus system analysis computes the 3 most probable fault causes.

The 3 most probable fault causes are given in a list.

The most probable fault cause is at the top of the list.

Message in the BMW diagnosis system

The fault causes detected are as follows:

- [1] ** ** Cause of fault PT-CAN
- [2] ** Cause of fault ZGM
- [3] * Cause of fault ...
- [4] End test module

The most probable fault cause is given under [1]. Select inspection step.

Note: The number of stars denotes priority.

The stars in front of a cause of fault indicate how probable the cause of fault is. 5 stars denote the most likely cause of fault.

1 star is allocated to a cause of fault that has very low probability.

Step 6: Selection of the test module

Terminating resistors

The installation locations are listed below for the purposes of measuring the terminating resistor values.

> R56

- **PT-CAN**

- 1 resistor is in the SZL control unit in the version with steering angle sensor (SZL: steering column switch cluster)
- 1 resistor is in the EPS control unit (EPS: electro-mechanical power steering)

- **F-CAN**

- Vehicles with Dynamic Stability Control (DSC)
- 1 resistor is in the DSC control unit
- 1 resistor is in the DSC sensor (under the front-passenger seat)

> E60, E61, E63, E64

- **PT-CAN**

- 1 resistor is in the DSC control unit (DSC: dynamic stability control)
- 1 resistor is in the SGM control unit (safety and gateway module)
- From 09/2005, this resistor is in the KGM control unit (body-gateway module)

- **F-CAN**

- Vehicles with AS (Active Steering)
- 1 resistor is in the cumulative steering-angle sensor in the steering box.
- 1 resistor is in the DSC sensor (under the front passenger seat).
- Vehicles without AS (Active Steering)
- 1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
- 1 resistor is in the DSC sensor 2 (under the front-passenger seat; DSC sensor 1 is under the driver's seat).

> E65, E66

- **PT-CAN**

- 1 resistor is in the wiring harness at the front on the right spring strut dome. This resistor can be disconnected from the PT-CAN.
- 1 resistor is in the wiring harness under the back seat. This resistor cannot be disconnected.

> E87, E90, E91, E92, E93

- **PT-CAN**

Different terminating resistors are used depending on the motorisation:

- Vehicles with engine N4... (basic variant and High equipment)
- 1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
- 1 resistor is in the JBE control unit (JBE: junction box electronics)
- Vehicles with engine M47, M57, N5... (basic variant and High equipment)
- 1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
- 1 resistor is in the EKP control unit (EKP: controlled fuel pump)

- Vehicles with engine N4... (basic variant and High equipment)
1 resistor is in the SZL control unit (SZL: steering column switch cluster)
- Vehicles with engine M47, M57, N5... (basic variant and High equipment)
1 resistor is in the DSC control unit (DSC: Dynamic Stability Control)
1 resistor is in the SZL control unit (SZL: steering column switch cluster)

MOST system analysis

The MOST bus has a ring structure. This means that a fault in one control unit can have an effect on the entire system. The cause of a system fault (= communication fault) in the MOST network is not readily apparent.

The "MOST system analysis" test module (BMW diagnosis system from DIS CD 36) was developed in order to analyse faults in the communication of MOST control units.

The MOST system analysis has been improved in DIS-CD 38.

Note: Path details for the "MOST system analysis" test module

The test module is called up in the DIS (Diagnosis and Information System) as follows:

"Function selection" button -> Complete vehicle -> Body -> Bus functions -> MOST functions -> MOST system analysis.

In order to determine the cause of a system fault in the MOST network, the following prerequisites have been established:

- If a communication fault occurs in MOST control units, then this communication fault is not shown in the fault memory of the control unit concerned. This also means that no "x" appears before this control unit in the short test.
- In addition to the list of "really" fitted control units in the short test, a "virtual" control unit appears called "MOST system analysis".

In this case, "virtual" means that this is not a real control unit, but a wild card for all MOST control units.

- The short test for the "MOST system analysis" "virtual" control unit reads the communication faults of all the MOST control units.
- An "x" in front of this "MOST system analysis" "virtual" control unit indicates that the short test has analysed one of the following faults:
 - No communication with the following control units:
 - > R56
CCC: Car Communication Computer
RAD2: radio 2 (Radio Boost)
 - > E60, E61, E63, E64
CCC or M-ASK: car communication computer or multi-audio system controller
 - > E65, E66
CD: Control Display
 - > E87, E90, E91, E92, E93
CCC or M-ASK: car communication computer or multi-audio system controller
RAD2: radio 2 (BMW "Professional" radio)
 - MOST ring break